The RUBBER RESEARCH INSTITUTE of CEYLON

Vol. 37 Part 1

1st QUARTERLY JOURNAL

MARCH 1961

23 MAY 1961

RUBBER RESEARCH INSTITUTE OF CEYLON

1st Quarterly Journal

VOL. 37 PART 1 **MARCH 1961**

CONTENTS

PAGE

THE PERFORMANCE OF RRIC CLONES UNDER CEYLON CONDITIONS—by C. A. de Silva 1

DIRT CONTENT OF SCRAP RUBBER—by K. F. Heinisch 13

RECENT PROGRESS IN THE CONTROL OF THE WHITE ROOT DISEASE OF HEVEA—by A. Riggenbach 18

PLANTING TOPICS 22

QUESTION CORNER 24

MINUTES OF THE 169th and 170th MEETINGS OF THE RUBBER RESEARCH BOARD 27

NOTICES

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Those who wish to visit the Institute are requested to do so after making an appointment. No special days are set apart as Visitors' Days and the services of the technical officers can be availed of for discussion or demonstration only by prior appointment.

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The undernoted Advisory Circulars may be obtained on application at 30 cents per copy. Future issues in the series will be sent free of charge to estates and smallholders registered for the receipt of our publications:—

(5) Straining box for latex (January, 1940).

(12) Warm Air Drying House for Crepe Rubber (Reprinted 1952).

(33) Mechanical Felling of Rubber Trees (Reprinted March, 1955).

(37A) Manuring—Magnesium Deficiencies in Rubber (July, 1954).

(37B) Potassium Deficiencies (September, 1954).

(38) Planting and After-Care of Budded Stumps and Stumped Budgrafts (Superseding Advisory Circular No. 8) (March, 1953).

(39) Clonal Seed as Planting Material (Superseding Advisory Circulars No. 26 and 27) (July, 1953).

(41) Pink Disease (June, 1954).

(44) Diplodia Dieback and Collar Rot of Hevea and Blue Spot of Crepe Rubber (June, 1954).

(47) Ustulina Rot of Rubber Trees (November, 1954).

(49) Root Disease in Replanted Areas (Superseding Advisory Circular No. 31) (October, 1951).

(50) Orange Gall of Hevea (December, 1954).

(51) Bird's Eye Leaf Spot of Hevea (December, 1954).

(56) Cover Crops (Superseding Advisory Circular No. 25) (October, 1955).

(57) Notes on Rubber Seedling Nurseries (Superseding Advisory Circular No. 35) (October, 1955).

(58) Notes on Budgrafting Procedure (Superseding Advisory Circular No. 1) (December, 1955).

(60) Sale of Budwood (Superseding Advisory Circular No. 42) (June, 1958).

(61) Prevention of Coagulation in the Field (Superseding Advisory Circular No. 53) (September, 1958).

(62) The White Root Disease of Hevea—Fomes Lignosus (Superseding Advisory Circular No. 46) (October, 1958).

(63) Brown Root Disease of Hevea—Fomes Noxius (Superseding Advisory Circular No. 48) (December, 1958).

(64) Bark Rot and Canker of Hevea—Phytophthora Palmivora (Superseding Advisory Circular No. 54) (December, 1958).

(65) The Phytophthora Leaf Disease of Hevea—Phytophthora Palmivora (Superseding Advisory Circular No. 45) (December, 1958).

(66) Manuring of Rubber (Superseding Advisory Circulars No. 59 & 59A) (April, 1959).

(67) A Simple Method of Control of Latex Coagulation. (February, 1960).

(68) Minor Pests of Rubber Plantations (June, 1960).

(69) Defects in Smoked Sheet. (September, 1960).

(70) Oidium Leaf Disease (Superseding Advisory Circular No. 43). *In preparation.*

(71) Tapping of Hevea Rubber (Superseding Advisory Circular No. 40). *In preparation.*

THE PERFORMANCE OF RRIC CLONES UNDER CEYLON CONDITIONS

By

C. A. De Silva

The earliest attempts to establish clonal rubber by budgrafting in Ceylon are briefly described with reference to the study of the inter-relationship of yield and growth factors for the selection of seedling mother trees as clone parents.

The clones established from unselected, near-legitimate and legitimate seedlings are described and yield data and secondary characters of the selected clones are presented.

The range of elevation and climatic conditions of rubber growing land, which favour the diseases caused by Oidium heveae and Phytophthora palmivora, are presented. As the cost of treatment of these diseases is an appreciable factor in the economics of rubber production the question of making reliable recommendations to the rubber planting industry in Ceylon, during a transitional period of evaluation of selected clones, is briefly discussed.

The early attempts to improve the yields of *Hevea* in Ceylon followed very much the same pattern as in most other eastern rubber growing countries. High-yielding unselected seedling rubber trees on commercial estates were selected as mother trees of new clones propagated by budgrafting. Parsons (1922) of the Department of Agriculture of Ceylon successfully established the budgrafting procedure as a practical method between 1920 and 1924.

A comprehensive study of the relationship between yield and other vegetative factors such as girth and number of vessels in the laticiferous tissues was undertaken by Taylor (1926).

The material used was a collection of progeny of the historic high-yielding tree Heneratgoda No. 2, which was one of the seedling trees raised at Kew Gardens from seed brought by Wickham from Brazil and sent to Ceylon in 1876.

The inter-relationship of the various vegetative factors with yield was worked out statistically in the form of correlations in the hope that the information might prove of some value in the selection of suitable seedling trees for propagation by budgrafting. Similar studies had been carried out earlier by Heusser (1919) and Bobilioff (1923) with unselected seedlings. The established positive correlations were, however, considered too low to provide a basis on which reliable selections could be made for the establishment of clones.

Clones and seedling mother tree material:

(*a*) *Clones Established from Unselected Seedlings on Commercial Estates.*

Taylor and Murray of the Rubber Research Scheme (Ceylon) established and test tapped a selection of 170 clones derived from high-yielding unselected seedling trees on commercial estates from 1926 to 1935. Only three of these clones, namely,

Mil (Millakande) 3/2, Wag (Wagga) 6278 and Hil (Hillcroft) 28, were planted on a large scale. At ten years of age the original budgrafts of these clones were yielding 17.1, 17.7 and 13.7 lb. dry rubber per tree per year respectively, and were the best yielding clones on preliminary trial.

At the present time, under favourable conditions of growth and production, both clones Wag 6278 and Mil 3/2 are yielding up to 1,800 lb. dry rubber per acre per year on commercial estates in Ceylon. Clone Hil 28 is yielding well over 1,000 lb. per acre per year on many estates but is no longer recommended because of a marked fluting of the trunk and of its yellow latex.

(*b*) *Clones Established from the Prang Besar Isolation Garden Seedlings.*

These clones were established for the first time in 1936/37 as 3-tree clones from selected PBIG seedling trees planted in 1935.

One hundred and thirty three clones were established from PBIG Plot C seedlings and 57 clones from seedlings of clone SR 9 from Plot B. The clones were budded in the field in 1936/37 in the 1935 clearing of the Nivitigalakele Station. Ford, appointed Geneticist in 1938, took over the selection of the 3-tree clones. He made a preliminary selection of the clones in experimental tapping, taking into account the yield, growth, secondary characters and the location of the mother seedling trees.

In 1945 a final selection of 6 'PBS' clones was made in the fourth year of tapping. The yield data are presented in Table 1, together with the yield and growth figures of the PBIG mother seedling trees. At the present time the 'PBS' clones are designated as clones RRIC 2 to 7, as shown in Table 2 with yield and growth records. It is interesting to note the outstanding yield and girth of the seedling mother tree of clone 'PBS' 181 now designated as RRIC 7, the best of the clones of the series in the 1945 Clone Trial at Hedigalla Station. Clone RRIC 7 has been placed ninth in ranking for vigour of growth at 2 years of age from a total of 100 clones, as presented by PAARDEKOOPER (1959) in the early results of the RRIM 'Exchange Clones' Trial P. (1954 Collection).

(*c*) *Clones Established from Seedlings Grown from Tjikadoe Seed.*

In 1938 Ford selected 51 Tjikadoe seedling trees on Nabunnatenne Estate, Ceylon, and test tapped the trees in December-January 1938/39. The early results were presented by DE SILVA (1949).

Twenty three trees were selected on yield and on growth characters for establishing clones of the 'Nab' series which were planted in the 1939 Clone Trial at Nivitigalakele Station. Four clones, namely, Nab 12, 15, 17 and 20, planted on a steep slope with poor growing conditions, gave promising yields in the early years of tapping. The yields of the four clones and of their seedling mother trees, with secondary characters, are given in Table 3. In a large-scale clone trial planted in 1952 at Dartonfield Station clones Nab 15 and 20 have given better yields than the control clone PB 86 in the second year of tapping. Clone Nab 20 in the earlier trial has shown a marked susceptibility to Brown Bast; the trees have a leaning habit, especially in closely planted rows of avenue planting systems. Clone Nab 17 has been the highest yielding clone in both clone trials, but is unfortunately susceptible to Brown Bast and to *Phytophthora* diseases. Clone Nab 15 is recommended for commercial planting on a moderate scale.

Hand-pollination programmes for establishing clones from legitimate seedlings:

Ford carried out hand-pollination programmes from 1939 to 1941. During the war period, pollination programmes were carried out on a small scale from 1942 to 1944 by Sharp of the Rubber Research Institute of Malaya, who was working as Temporary Botanist of the R.R.I.C. during this period. Ford returned to work from war service in 1944, and carried out in 1945 the biggest pollination programme which produced approximately 5,200 H.P. seedlings. Approximately 6,600 H.P. seedlings and a total of about 3,300 clones have been planted in 3-tree and 5-tree clones on the Institute's experimental stations up to 1952. The observations on the clones planted out from 1946 to 1952 have not been fully completed and the present paper is confined to a description of the selected clones planted in clone trials up to 1943.

(*a*) *Clones Established from* 1939 *H.P. Seedlings.*

Cramer's 'Testatex' knife was used for selecting the better yielding seedlings as clone mother trees. Only the seedlings in 'Testatex' classes 1 to 4 were used for establishing clones; class 5 was discarded as the poorest seedlings. The test-pricking classes 1 to 5 indicated the order from the best to the worst class of seedlings for yield capacity. No significant relationship has, however, been established between the 'Testatex' class of the yielding capacity of the mother seedling with that of its vegetatively propagated progeny. The use of the 'Testatex' knife is, however, considered as a satisfactory method for discarding the poorest class of seedlings in the nursery.

Ninety five 5-tree clones established from the 1939 H.P. seedlings were planted in a 7-acre block at the Nivitigalakele Station in 1941. The yields, growth figures and secondary characters are presented in Table 4. It is interesting to note that the selected clones are confined to 'Testatex' classes 1 to 3. Incidentally the 1941 7-acre block has given a commercial estate yield of 1,226 lb. per acre in 1959, indicating the class of material from which the clones in Table 4 have been primarily selected.

(*b*) *Clones Established from* 1940 *H.P. Seedlings.*

Ninety 3-tree clones established from 1940 H.P. seedlings were planted in the 1944 Clone Trial in a $4\frac{1}{2}$-acre rocky area in virgin jungle at the Nivitigalakele Station.

This area produced a most vigorous growing stand of budded rubber to give two of the highest yielding RRIC clones No. 28 and 45. The data on yield, growth and secondary characters are presented in Table 5.

Clone RRIC 28 is unfortunately susceptible to wind damage in the 1954 large-scale clone trial at Hedigalla Station. It has a slightly fluted trunk inherited from its male parent, clone Hil 28, which is decidedly fluted. Clone RRIC 45 is one of the best yielding clones tested on a small scale and has good secondary characters. It is placed eighth in ranking for vigour of growth at two years of age from a total of 100 clones in the RRIM 'Exchange Clones' Trial P. (1954 Collection), as presented by PAARDEKOOPER (1959).

(*c*) *Clones Established from* 1941 *H.P. Seedlings planted on Hedigalla Station.*

The 1941 H.P. seedlings provided the material for the 1943/44 Clone Trial in the first experimental block of 12 acres at the Hedigalla Station, developed from 1,000 acres of crown forest leased out in 1942 to the then Rubber Research Scheme by the Government of Ceylon.

Two hundred and sixty nine 5-tree clones were planted in the 1943/44 Clone Trial and the yield results are presented in Table 6. The clone parents PR 107 and PB 86 and, to a lesser degree, Tjir 1 and 16 are susceptible to *Phytophthora* diseases but this susceptibility was not evident at the time these clones were used as clone parents. The incidence of Bark Rot and Canker in clones RRIC 36 and 74 is therefore not surprising in view of their parentage. They should, however, be suitable for the drier rubber planting districts of Ceylon and perhaps in other countries where *Phytophthora* leaf and bark diseases are not a serious problem. The cost of fungicidal treatment of *Oidium* and *Phytophthora* diseases in Ceylon is fast becoming an appreciable factor in the economics of rubber production.

(*d*) *Clones Established from* 1943/44 *H.P. Seedlings.*

Three hundred and fifty one clones, established from the 1943/44 H.P. seedlings, were planted in the 1946 and 1947 Clone Trials at the Hedigalla Station. The general trend of early selected clones from 1955 to 1959 is given in Table 7. Two clones selected on promising yields in the second year of tapping, RRIC 61 and 62, are maintaining their high yields. The secondary characters of these clones will be studied more fully with further test tapping and observations in the field.

(*e*) *Clones Established from* 1945 *H.P. Seedlings.*

The 5233 H.P. seedlings from the 1945 hand-pollination programme in the nurseries presented a major problem in the post war period, when the Geneticist resigned his post in 1945. The Botanist and the Mycologist planted 1100 5-tree clones, established from selected H.P. seedlings, on ten commercial estates in 1946/47. A further 1220 five-tree clones have been planted from 1950 to 1952 at the Dartonfield and Hedigalla Stations. The clones are being test tapped at the present time and more exacting standards of early selection are being used for making a short list of new RRIC clones for further testing. Any detailed reference to the performance of these clones at this stage will be beyond the scope of this paper.

Three RRIC Clones of especial interest:

In our efforts to establish high-yielding clones we have been more fortunate with the clones established up to the present from near-legitimate seedling trees than with those established from hand-pollinated seedlings, especially with regard to disease resistance. In a few instances we have introduced into our large-scale clone trials clones selected at a very early age on promising characters. Of these clones, RRIC 52, 86, and 88, which are being tested with 25 to 150 trees of each clone, are described in some detail.

(*a*) *Clone RRIC* 52

Clone RRIC 52 was established in 1944 from a high-yielding Tjikadoe seedling planted in 1932. Five trees of this clone were planted in a small-scale clone trial in 1944. The yield results of clone RRIC 52 compared with two control clones, PB 6/5 and Wag 6278, are given in Table 8. Clone RRIC 52 is shade tolerant

and is the most vigorous growing clone in our collection of foreign and local clones in tapping at the present time. The clone showed a partial wintering in the eleventh year of growth and has wintered only partially in subsequent years. It is tolerant to both *Oidium* and to *Phytophthora* diseases. In the polyclone block of the 1944 Clone Trial it has dwarfed the clones growing alongside it in the row and its branching system is of a very desirable type. The general growth characters of clone RRIC 52 are shown in Figures 1 to 3 and the yield results in the 1949 Clone Trial, planted 6 × 45 ft, are given in Table 9. The clone is inherently a moderate yielder and depends on its outstanding girthing qualities for high yields. Clone RRIC 87, also is up to the standard of yield of clone RRIC 52, as indicated in Table 9.

(*b*) *Clone RRIC* 86

Clone RRIC 86 was established from a high-yielding PBIG seedling and 150 trees of this clone were planted in the 1949 Clone Trial, together with clone RRIC 52. Its secondary characters are also very satisfactory with a straight trunk and good branching habit. It is yielding up to the standard of clone PB 86 in the third year of tapping, as shown in Table 9. Clone RRIC 86 in its tenth year of age is illustrated in Figure 4.

(*c*) *Clone RRIC* 88

Clone RRIC 88, originally designated as clone PBS 13, was established from a high-yielding PBIG seedling in 1936. Twenty five trees were planted in the 1946 Clone Trial at Nivitigalakele Station and the trees were tapped from 1953. In 1959 the 25 trees have given a yield of 19.8 lb. dry rubber per tree per year at 15 years of age, with an average girth of 35.3 in. and a virgin bark thickness of 12 mm. Clone RRIC 88 has a straight trunk with a good branching habit and only one tree has so far been damaged by wind in an area exposed to strong monsoon winds.

The growth of the fourteen-year-old trees of the clone is illustrated in Figure 5.

Individual yield recording has been carried out on twenty four trees of the clone on two consecutive tapping days of June 1960 and the yield records are summarised in a histogram given in Figure 6. The trees show a fair uniformity in yielding capacity with an average yield of 65.2 grams of dry rubber per tree per tapping and a coefficient of variability of 26.1.

The three clones RRIC 52, 86 and 88 may be recommended for planting up to ten acres of each clone on sizable rubber estates with a comprehensive replanting programme.

General Conclusions:

On most commercial estates in Ceylon of less than 2,000 acres in extent it is only practicable to plant out new promising clones on an experimental scale of one or two tapping tasks of each clone. We are thus compelled to fall back on our own resources for large-scale clone trials on the Institute's experimental stations.

The Hedigalla Station, with a rainfall of about 200 inches per year and a western aspect in mountainous terrain, is subjected to strong monsoon storms. With late drying conditions in continued monsoon wet weather periods, the clones become susceptible to attacks of *Phytophthora* diseases and are damaged by wind storms, as may be seen in Table 9. The uprooted trees are not taken as a sign of

susceptibility to wind damage but of poor anchorage on soil of limited depth. The clones tested at Hedigalla are therefore subjected to a rigid test for resistance to *Phytophthora* diseases and to wind damage, which are not of general occurrence in all rubber planting districts of Ceylon.

We are unfortunately caught up in a transitional stage when the RRIC clones, planted in large-scale clone trials from 1953 to 1957, can hardly give us the necessary information at this early stage for making final recommendations to the rubber industry on new planting material developed since 1941. There is an urgent necessity for obtaining high yields per acre to offset the cost of treatment of *Oidium* and *Phytophthora* diseases.

There is a range of rainfall from about 70 to 220 inches per year and an elevation from 50 to 1,500 feet in rubber growing areas of Ceylon. Flat or undulating land is the exception rather than the rule. The best growth can only be obtained with liberal manuring of both mature and immature plantings. There are, on an average, about 280 tappings per year with a high percentage of late-tapping and 'washout' days, in the wet low-country districts, which reduce yields per acre considerably, compared with those obtained in rubber growing countries with a drier climate.

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TABLE 1

1936 Clone Trial, Nivitigalakele Station

Yield and girth of selected 'PBS' clones and of their PBIG seedling mother trees

Clone	No. of trees tapped	Yield in lb. d. r. per tree 1944/45	Mean girth in in. Jan. 1944	Brown Bast cases	PBIG seedling mother tree		
					Female parent	Yield in lb. d.r. 1944/45	Girth in in. Jan. 1944
PBS 66	3 – 2	12.1	31.9	1	PB 38	14.0	34.8
PBS 69	2 – 3	12.8	26.7	0	PB 38	9.2	42.8
PBS 70	3 – 2	12.5	23.7	0	PB 38	13.5	29.9
PBS 90	1 – 3	14.6	30.9	1	PB 56	10.0	28.0
PBS 111	2 – 1	15.3	28.2	1	PB 86	14.7	33.0
PBS 181	3	13.2	29.5	0	SR 9	33.3	45 0

TABLE 2

1945 Clone Trial, Hedigalla Station

Yield and secondary characters of clones RRIC 2 to 7

Clone	No. of trees tapped	Yield in lb. d.r. per tree 1959	Mean Girth in in. 1959	Bark thickness in mm.		No. of trees affected		General observations	
				Virgin bark	Renewed bark 7½ years	Canker and Bark Rot	Wind damage	Trunk characters	Colour of latex
RRIC 2 (PBS 66)	73	14.9	33.9	7.5	7.0	16	—	Straight cylindrical	Pale yellow
RRIC 3 (PBS 69)	73	12.5	29.0	7.5	6.5	5	—	Straight cylindrical	Pale yellow
RRIC 4 (PBS 70)	68	20.4	29 2	9.0	7.5	14	2	Straight cylindrical	Pale yellow
RRIC 5 (PBS 90)	75	20.4	32.2	9.0	8.0	10	—	Straight slightly fluted	Pale yellow to yellow
RRIC 6 (PBS 111)	75	14.2	28.5	8.5	7.5	21	—	Straight cylindrical	White
RRIC 7 (PBS 181)	73	19.8	31.3	8.0	6.5	4	2	Slightly curving	Yellow
Tjir 1 (control)	73	14.4	28.9	8.5	8.0	7	—	—	—

TABLE 3.

1939 Clone Trial, Nivitigalakele Station
Yield, growth and secondary characters of Nab clones and of their Tjikadoe seedling mother trees
Tapped S/2, d/2, 100% from 1945

Clone	No. of trees tapped	Mean yield in lb. d.r. per tree per year 1955 to 1959	Mean Girth in inches 1960	Bark thickness in mm. 1960		Tjikadoe seedling mother tree		
				Virgin bark	Renewed bark 9 years	Yield in gm. per inch of tapping cut 1938	Girth in inches 1938	No. of latex vessel rows
Nab 12	18	17.5	35.5	10.1	7.5	3.1	36.0	18
Nab 15	20	15.5	35.4	11.5	7.7	3.6	40.0	27
Nab 17	18	17.6	36.6	11.1	8.1	5.8	30.0	37
Nab 20	9	15.7	36.4	9.8	7.0	3.2	35.0	25
PB 86 (control)	19	19.2	37.0	11.2	8.2	—	—	—

TABLE 4.

1941 Clone Trial, Nivitigalakele Station
Yield, growth and secondary characters of clones established from 1939 H.P. seedlings. Tapped S/2, d/2, 100%.

Clone	Parentage	No. of trees tapped	Mean yield in lb. d.r. per tree per year 1955-1959	Testatex class	Mean girth in in. 1959	No. of trees affected			Thickness of renewed bark in mm. 8 years	General observations	
						Canker and Bark Rot	Brown Bast	Wind damage		Trunk characters	Colour of latex
RRIC 13	RRIC 8 × Mil 3/2	3	23.5	1	43.8	—	—	—	11.0	Straight, uneven	Yellow
RRIC 9	RRIC 8 × Mil 3/2	3	22.7	1	51.5	—	1	—	12.0	Straight, slightly fluted	—
RRIC 51	RRIC 8 × Mil 3/2	5—4	20.7	2	51.0	1	2	1	10.5	Straight, cylindrical	Pale yellow
RRIC 17	RRIC 8 × Mil 3/2	3—4	20.0	3	50.3	1	2	—	10.5	Straight, uneven	Pale yellow
RRIC 16	RRIC 8 × Mil 3/2	4	20.0	3	46.8	—	3	—	13.0	Slightly leaning	Pale yellow
RRIC 24	RRIC 8 × Mil 3/2	5	18.3	—	48.2	2	—	—	7.0	Straight	—
RRIC 14	RRIC 8 × Wag 6278	5	16.1	1	41.2	—	1	—	11.0	Straight, cylindrical	Yellow
Wag 6278 (control)		5	18.1	—	—	—	—	—	—	—	—

TABLE 5.

1944 Clone Trial, Nivitigalakele Station
Yield, growth and secondary characters of RRIC clones established from 1940 H.P. seedlings. Tapped S/2, d/2, 100%.

Clone	Parentage	No. of trees tapped	Mean yield in lb. d.r. per tree per year 1955 to 1959	Mean girth in inches 1959	No. of trees affected			Thickness of renewed bark in mm. 9 years	General observations	
					Canker and Bark Rot	Brown Bast	Wind damage		Trunk characters	Colour of latex
RRIC 28	RRIC 8 × Hil 28	1	41.3	52.0	1	—	2	11.0	Straight slightly fluted	Pale yellow to yellow
RRIC 45	RRIC 8 × Tjir 1	3	40.9	44.0	1	—	—	12.0	Straight cylindrical	White
RRIC 41	RRIC 8 × Tjir 1	2	38.9	40.0	—	2	—	9.5	Straight slightly knobby	White
RRIC 31	RRIC 8 × Tjir 1	3	31.2	49.0	1	—	—	11.0	Slightly fluted and leaning	—
RRIC 39	RRIC 8 × Tjir 1	2	28.1	41.3	1	—	1	9.0	Straight cylindrical	—
RRIC 40	RRIC 8 × Hil 28	2—3	26.7	49.0	1	—	—	11.0	Slightly fluted	—
RRIC 42	RRIC 8 × Tjir 1	1	25.1	34.0	—	1	—	11.5	—	—
RRIC 60	RRIC 8 × Hil 28	3	24.8	45.5	—	2	—	10.0	Slightly leaning and twisted	—
RRIC 59	RRIC 8 × Hil 28	3	24.4	44.0	—	—	—	11.0	Straight cylindrical	Yellow
Wag 6278 (control)		5	20.5	—	—	—	—	—	—	—

TABLE 6.

1943 Clone Trial, Hedigalla Station
Yield, growth and secondary characters of RRIC clones established from 1941 H.P. seedlings. Tapped S/2, d/2, 100%.

Clone	Parentage	No. of trees tapped	Mean yield in lb. d.r. per tree per year 1955—1959	Mean girth in in. 1959	No. of trees tapped			Thickness of renewed bark 10 years	General observations	
					Canker and Bark Rot	Brown Bast	Wind damage		Trunk characters	Colour of latex
RRIC 75	RRIC 8 × Tjir 16	2	35.8	39.8	—	1	1	9.0	Cylindrical, Slightly leaning	—
RRIC 76	TKD 113* × RRIC 8	4	30.1	42.3	—	—	—	10.5	Straight, slightly fluted	Yellow
RRIC 37	RRIC 8 × Diy 1	4	28.2	36.8	3	—	—	8.5	Straight, cylindrical	Pale yellow
RRIC 47	Diy 1 × Mil 3/2	4	27.3	39.9	—	—	—	10.5	Straight, slightly fluted	Pale yellow
RRIC 36	PB 86 × PR 107	4	27.1	42.9	4	—	—	10.5	Straight, cylindrical	Pale yellow to yellow
RRIC 79	PB 86 × M 162	5	26.4	43.5	—	—	—	9.0	Straight, unevenly cylindrical	—
RRIC 33	RRIC 8 × Dal 5315	5	25.4	45.8	—	—	—	9.5	Straight, cylindrical	White to pale yellow
RRIC 50	Tjir 1 × PB 8	4	24.0	40.5	1	—	—	10.5	Straight, cylindrical	—
RRIC 35	PB 86 × Tjir 1	5	22.6	40.2	—	—	—	9.0	Straight, slightly fluted	—
RRIC 74	PB 86 × PR 107	5	22.5	—	5	—	—	—	Straight, cylindrical	—
RRIC 38	PB 86 × PR 107	5	20.0	37.2	1	—	—	9.0	Straight, slightly fluted	—
RRIC 48	TKD 113* × RRIC 8	4	18.9	23.9	—	—	—	6.0	Straight, cylindrical	—
RRIC 32	RRIC 8 × H 24	5	18.9	35.8	—	—	—	8.0	Straight, cylindrical	—

*High-yielding Tjikadoe seedling tree.

TABLE 7.

1946 and 1947 Clone Trials, Hedigalla Station.

Yield and girth of RRIC clones established from 1943 and 1944 H.P. seedlings

First tapped in 1953/54 on S/2, d/3, 67%. Tapped S/2, d/2, 100% from 1956/57.

Clone	Parentage	No. of trees tapped	Yield in lb. d.r. per tree per year					Mean girth in inches	Bark thickness in mm.		No. of trees affected	
		1959	1955	1956	1957	1958	1959	1959	Virgin bark	Renewed bark 1959 5½ to 7½ years	Canker and Bark Rot	Wind damage
RRIC 61	PB 86 × RRIC 8	4	10.1	17.0	14.1	17.3	26.8	33.3	9.0	7.5	—	1
RRIC 62	PB 86 × RRIC 8	4	10.7	12.1	15.4	16.4	25.8	31.4	8.0	8.0	—	1
RRIC 77	PB 86 × RRIC 8	4	10.4	16.1	14.7	18.5	20.8	35.0	8.5	7.0	1	—
RRIC 54	PB 86 × Wag 6278	5	12.8	20.9	21.3	25.2	19.7	34.4	9.5	8.5	—	—
RRIC 65	PB 5/139 × TKD 113	5	8.6	15.2	18.3	22.3	21.1	31.1	7.5	6.0	—	—
RRIC 66	PB 5/139 × TKD 113	5	5.8	13.9	15.2	15.0	20.7	31.1	7.5	6.5	—	—
RRIC 64	PB 5/139 × TKD 113	5	15.0	22.6	21.2	29.3	16.5	31.7	7.5	7.0	—	—
	Mean yield of all clones		10.5	16.8	17.2	20.7	21.6	—	—	—	—	—
Tjir 1 (control)		5	6.0	12.0	12.6	17.4	16.4	—	—	—	—	—

TABLE 8

1944 Small-Scale Clone Trial, Hedigalla Station

Yield in lb. d.r. per tree per year. Tapped S/2, d/2, 100% from May, 1951

Clone	No. of trees tapped 1959	Yield								No. of trees affected		Mean girth in in. 1959	Thickness of renewed bark (9 years)
		1952	1953	1954	1955	1956	1957	1958	1959	Canker and Bark Rot	Wind damage		
RRIC 52	3	7.2	8.3	13.1	12.7	17.7	23.9	34.5	25.1	—	1	51.6	9.0
PB 6/5	4	10.3	9.1	13.1	13.1	19.8	20.3	25.0	20.8	1	2	30.0	6.8
Wag 6278	5	6.2	6.3	11.8	9.4	11.8	13.5	18.5	20.1	1	—	26.7	7.0

TABLE 9.

1949 Large-Scale Clone Trial, Planted 6 × 45ft., Hedigalla Station

Tapped S/2, d/3, 67% from July 1956 and S/2, d/2, 100% in 1959. Yield in lb. d.r. per tree per year.

Clone	No. of trees tapped 1959	Yield 1959	No. of trees affected		Wind damage cases		Mean girth (in.) August 1955
			Canker and Bark Rot	Brown Bast	Branch and stem breakage	Uprooted	
Nab 17	121	13.3	21	—	1	27	18.7
RRIC 86	108	12.8	6	—	8	41	18.5
PB 86	126	12.1	5	—	6	22	18.3
Nab 20	111	11.0	—	2	14	34	19.5
RRIM 513	146	9.7	9	—	4	8	16.9
RRIM 501	126	9.6	3	1	10	21	16.9
RRIC 52	114	9.2	9	—	2	36	21.8
RRIC 87	137	9.3	3	—	—	13	18.3

Figure 1. Vigorous growth of clone RRIC 52 at 10 years of age. Planted 6×45 ft. Note contrast with tree of clone RRIM 513 on extreme left of row.

Figure 2. Good branching habit and vigorous growth of clone RRIC 52 at 16 years of age.

Figure 3. Tree of clone RRIC 52 at 16 years of age. Note dwarfing of adjacent trees of other clones.

Figure 4. Growth and branching of clone RRIC 86 at 10 years of age. Planted 6×45 ft.

Figure 5. Growth and branching of clone RRIC 88 at 14 years of age.

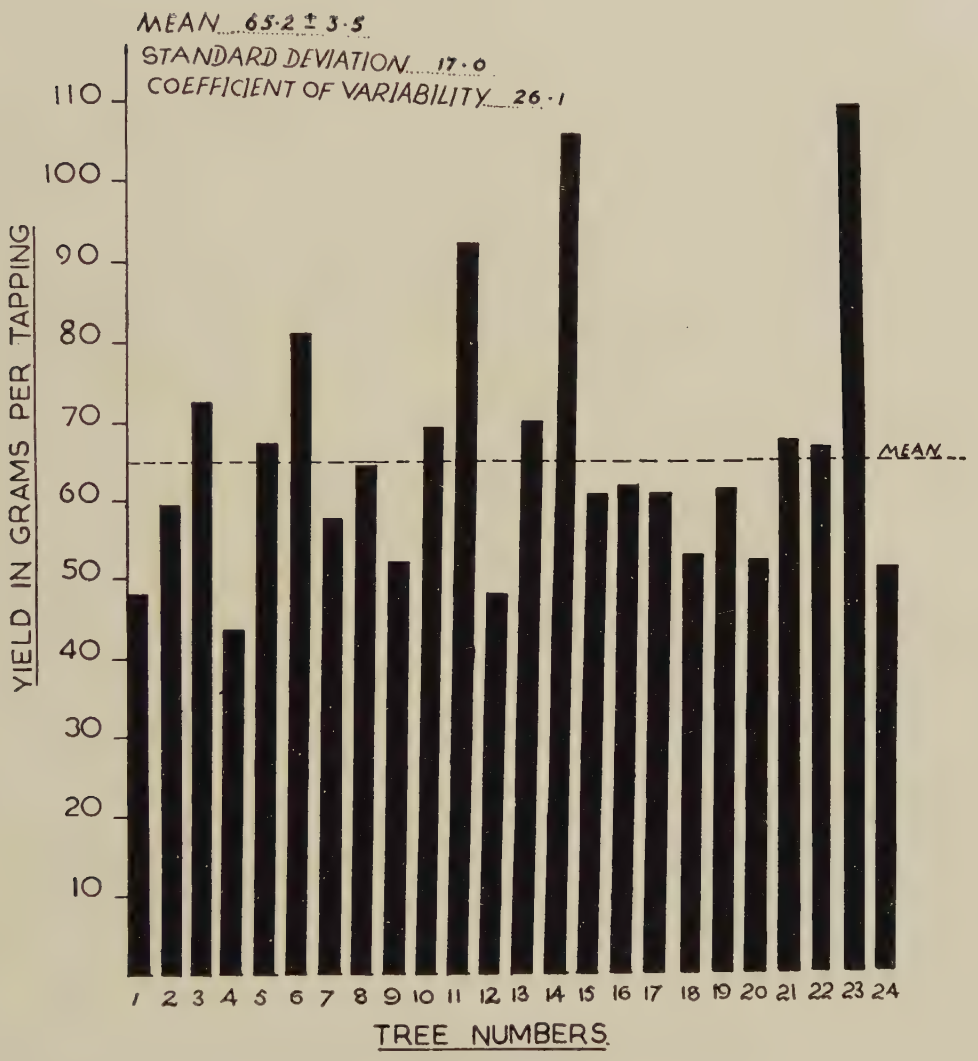


Figure 6. Histogram of individual tree yields of clone RRIC 88.

DIRT CONTENT OF SCRAP RUBBER

By

K. F. Heinisch

Introduction:

Statistics collected in rubber growing areas during the past ten years show that lower grade rubbers are in general highly contaminated with both organic and inorganic matter.

Consumers require a product which is as far as possible free from mechanical impurities, since the presence of dirt may cause difficulties during manufacture and may lower the quality of the manufactured goods. The importance of this problem is evident from the answers to a questionnaire on this matter by about eighty of the largest rubber manufacturers throughout the world. Cleanliness, besides uniformity, is one of the strongest advantages claimed for the synthetic rubbers over natural rubber.

Considering the technical and organizational aspects of rubber production it is almost impossible to prepare a perfectly clean rubber. Even rubber prepared with the greatest care generally contains minute amounts of impurities which may originate from the factory water as a result of contamination by dust etc., and which cannot in practice be avoided.

Not all contaminations are, however, harmful. Large amounts of mineral substances, such as clay, whiting, etc., are added as fillers to rubber mixes for certain trade purposes and it may be wondered, therefore, why very small amounts of sand, dust, and other contaminations should be objected to. Very fine particles below a certain size are indeed generally harmless. It was, therefore, desirable to define a harmful dirt content in order to be able to specify the degree of purity of rubber.

An accurate definition of the harmfulness of contaminations according to the particle size, quantity, or nature of the dirt is difficult to give, as their effect will depend on the nature and use of the finished product. For example a small amount of fine particles would be considered as harmful in the manufacture of some articles, such as thin walled goods, inner tubes, transparent and insulating materials, rubber cements and solutions etc., whereas a far greater quantity of coarser contaminations would be of no importance in the manufacture of other goods, such as soles, heels etc.

The most common defects which are ascribed to dirt are: fatigue cracking, ply separation in tyres and belting, air leakage, tearing, pin-holes, bad insulation, short circuits, electrical breakdown, discolourations, bad appearance, decrease of mechanical properties, insufficient smoothness and flaws.

A compromise had to be found acceptable to all manufacturers and it has generally been agreed to take as a standard of harmful dirt the residue that is retained on a 325 mesh screen (U.S. Standard) on sieving a rubber solution, as this mesh size is also accepted as the standard for compounding ingredients.

On the basis of statistical surveys a classification scheme for harmful dirt content has been proposed for rubber, and this is at present under consideration by the International Standardization Organization. Under this scheme the rubber could be classified into three groups with the following maximum harmful dirt limits: 0 to 0.05% super-clean; 0.05 to 0.15% clean; 0.15 to 0.30% general purpose, while a dirt content over 0.30% would be considered as an excess.

Much attention has also been paid to the reduction of the dirt content during preparation. It appears that in the case of latex crepe and estate smoked sheet a very clean product can be obtained when sufficient care is given to the collection and processing of the rubber. It is also possible to reduce the dirt content of unavoidably contaminated lower grade rubbers by means of certain simple procedures in manufacture. Extensive investigation and practical experiments on a large scale have been carried out and considerable experience has been obtained on practical ways of reducing dirt content.

Dirt Content of Ceylon Rubber:

An examination of the dirt content of Ceylon rubber, from the viewpoint of conformity to a possible future specification, has been started in 1959 and a tentative summary is given in Table 1, while Table 2 shows the percentage distribution over the quality groups.

TABLE 1

Dirt Content of Ceylon Rubber

Grade	No. of Samples	Arithmetic Mean	Highest Value	Lowest Value	Standard Deviation	Variability %	T-90%
R.S.S. 1 ...	69	.046	.075	.008	.0123	26.8	.062
R.S.S. 2 ...	50	.045	.108	.015	.0145	32.2	.063
R.S.S. 3 ...	44	.057	.111	.003	.0190	33.2	.080
R.S.S. 4 ..	32	.065	.142	.034	.0246	37.7	.098
R.S.S. 5 ...	8	.075	.102	.051	.0188	25.1	.094
Latex Crepe 1X	66	.026	.067	.007	.0118	45.6	.041
Latex Crepe 1A	58	.028	.060	.008	.0104	37.2	.041
Latex Crepe 1	253	.033	.117	.007	.0195	59.2	.063
Latex Crepe 2	167	.034	.082	.009	.0153	45.2	.058
Latex Crepe 3	193	.064	.329	.010	.0435	68.4	.117
Latex Crepe 4	68	.077	.356	.021	.0463	60.3	.119
Latex Crepe 5	28	.091	.238	.017	.0565	62.2	.171
Scrap Crepe 1	192	.239	.748	.024	.1787	74.8	.521
Scrap Crepe 2	154	.328	1.346	.043	.1953	59.6	.540
Scrap Crepe 3	129	.618	3.898	.043	.4868	78.8	1.181
Scrap Crepe 4	13	.534	1.295	.119	.3938	73.8	.908
Scrap Crepe 5	8	.562	1.464	.121	.4255	75.7	.755

Tables 1 and 2 show that first quality latex crepes have an average dirt content below 0.05%, the percentage of samples falling into the super-clean class being more than 80%. The lowest values are below 0.01% and the highest values, except some very few samples of probably accidental contamination, are found below 0.1%. The mean value for sheet No. 1 and 2 is also below 0.05%, but the percentage of samples in the super-clean class is less than for first grade crepes. There is a correlation between quality of sheet rubber and dirt content, which may be seen from the distribution in Table 2.

TABLE 2

Classification of Ceylon Rubber

Grade	0–0.049%	0.050–0.149%	0.150–0.300%	above 0.300%
R.S.S. 1 ...	71.0%	29.0%	—	—
R.S.S. 2 ...	68.0%	32.0%	—	—
R.S.S. 3 ...	36.4%	63.6%	—	—
R.S.S. 4 ...	25.0%	75.0%	—	—
R.S.S. 5 ...	—	100.0%	—	—
Latex Crepe 1X	93.9%	6.1%	—	—
Latex Crepe 1A	96.5%	3.5%	—	—
Latex Crepe 1 ...	85.4%	14.6%	—	—
Latex Crepe 2 ...	83.8%	16.2%	—	—
Latex Crepe 3 ...	46.6%	49.2%	3.1%	1.1%
Latex Crepe 4 ...	26.5%	70.5%	1.5%	1.5%
Latex Crepe 5 ...	17.9%	67.8%	14.3%	—
Scrap Crepe 1 ...	1.6%	43.2%	23.4%	31.8%
Scrap Crepe 2 ...	.7%	18.2%	31.1%	50.0%
Scrap Crepe 3 ...	2.3%	7.0%	17.1%	73.6%
Scrap Crepe 4 ...	—	7.7%	30.8%	61.5%
Scrap Crepe 5 ...	—	25.0%	25.0%	75.0%

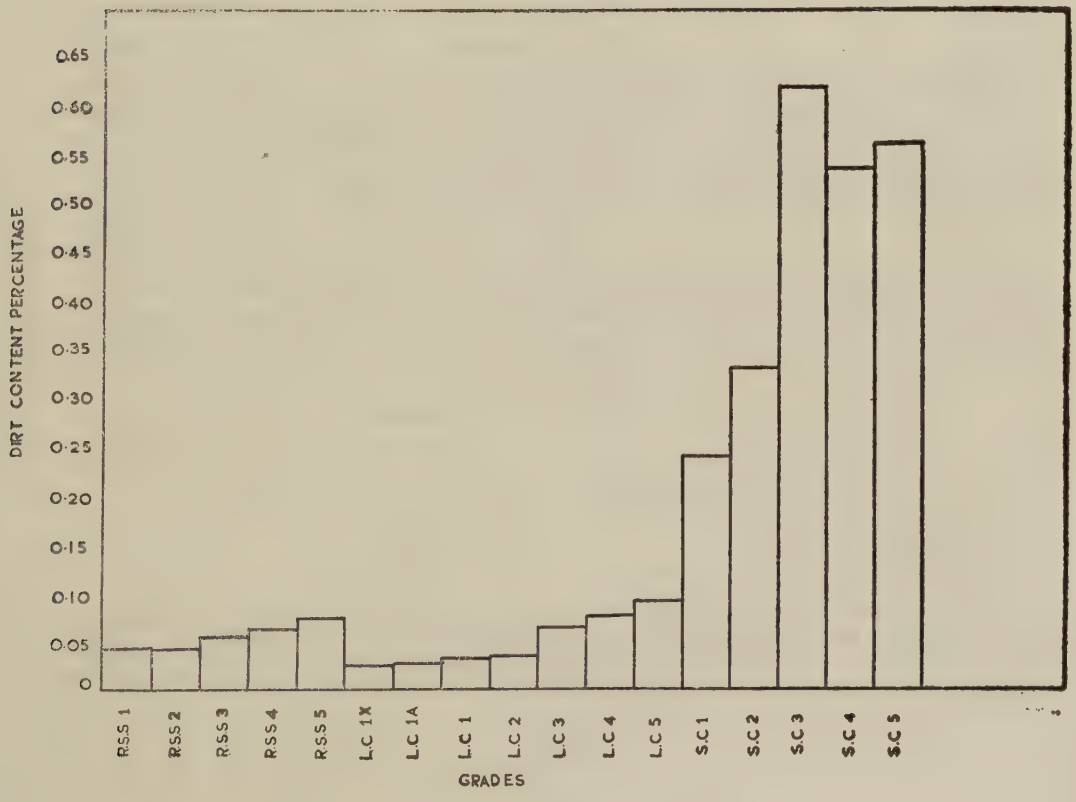
Scrap crepes are highly contaminated with both bark and sand and a very high percentage of the samples have a dirt content above 0.3% and these have to be regarded as too dirty.

The T-90% value in Table 1 indicates the highest dirt content of 90% of the samples after elimination of 10% of the highest values.

The histogram in Figure 1 shows the mean values of the dirt content of the different grades.

FIGURE 1

Histogram of mean values of dirt content



Reduction of Dirt Content:

Scrap crepe is generally highly contaminated with bark, sand and soil, as may be seen from Table 1 and, under adverse conditions, localized dirt may cause tacky spots and discolouration of the rubber. Although the normal milling procedure of scraps removes a major portion of the contamination, a substantial part remains behind in the rubber.

The washing operations can be considerably improved by soaking the scraps prior to milling in a solution of surface active agents. The best results have been obtained with anionic detergents, particularly of the alkylsulfate and alkylaryl-sulfonate types. The action of these chemicals is further improved by addition of so-called "builders" such as trisodium phosphate, sodium sulphate and others.

A 0.1 to 0.2% solution of a chemical, available under the trade name of "Detergent 40 E", with the addition of 0.1% trisodium phosphate, has proved to be very suitable, giving an average washing effect of 30–40%. Also other detergents, such as "Teepol", "Acto 600" and others, give a good washing effect but have the disadvantages of darkening the rubber or causing a slightly tacky surface. "Detergent 40 E" has no such effects and has no influence on the intrinsic properties of the rubber. It has been reported from estates in Ceylon to give not only a cleaner, but also a tougher rubber of better colour and general appearance.

Besides the primary effect in reducing the dirt content, "Detergent 40 E" may cause some improvement in the colour and in the processibility of the rubber. In large-scale trials carried out in a remilling factory in Sumatra with batches of 3,200 and 30,000 lb. of scraps and slab rubber respectively, equalling approximately 2,200 and 20,000 lb. dry rubber, and processed on a unit of 15 mills connected to a single generator, the results summarized in Tables 3 and 4 have been obtained.

TABLE 3

Quality Distribution

Grade	Normal Production			Treatment with "Detergent 40 E"		
	1	2	3	1	2	3
1st soaking ...	36%	47%	17%	72%	22%	6%
2nd soaking ...	12%	63%	25%	20%	64%	16%
3rd soaking ...	37%	49%	14%	70%	19%	11%
Mean ..	28%	53%	19%	54%	35%	11%

TABLE 4

Technical Data

	Normal production	Treatment with "Detergent 40 E"
Average number of rollings	14	10
Kilograms per hour	1,670	2,340
KWh per 1,000 kg. rubber	102	73
Cost of power per 1,000 kg.	100%	72%

To show the influence of treatment with "Detergent 40 E" on the level of the contamination some average figures from large-scale practical trials with 400 lb. of scraps each are given in Table 5.

TABLE 5

Influence of "Detergent 40 E" on Dirt Content

Grade	Manufacture	
	Without Detergent	With "Detergent 40 E"
3X	0.544%	0.364%
2X	0.315%	0.146%
1X	0.294%	0.131%

Table 6 shows in addition that the number of passages of the rubber through the mills may also be of importance.

TABLE 6

Influence of passages through mills (without Detergent)

Grade	Number of passages		
	15	19	25
3X	0.47%	0.30%	0.22%
1X	0.26%	0.16%	0.13%

Practical Applications:

In estate practice the scraps should be soaked for at least one day or, if circumstances in the factory allow it, two to three days in a solution, containing 0.1–0.2% of "Detergent 40 E" and 0.1% trisodium phosphate. Thereafter the usual procedure of manufacture, including treatment in the scrap washer, is applied with the use of ample water on the mills. The soaking solution can be used up to three times, depending on the degree of contamination.

A considerable increase of the outturn of first grade scrap crepe may be obtained by sorting out the different scraps according to colour. In a large factory over a period of several weeks 46% scrap crepe No. IX have been obtained without sorting, compared with 74% with sorting prior to milling.

RECENT PROGRESS IN THE CONTROL OF THE WHITE ROOT DISEASE OF HEVEA

By

A. Riggenbach

The method of control of the White Root disease of the rubber tree, Hevea brasiliensis, Muell. Arg. caused by the fungus Fomes Lignosus (Klot.) Heim, consisting of the surface application to infected roots of a copper sulphate solution after scraping off the fungus mycelium, gave disappointing results. Consequently laboratory tests and field experiments with a wide range of fungicides were carried out at the Rubber Research Institute of Ceylon.

As a result of these experiments and of the successful use in commercial areas replanted with rubber, Tillex, an organo-mercurial fungicide, is now recommended by the Institute, instead of copper sulphate, for the control of the White Root disease of Hevea.

The White Root disease of the rubber tree, *Hevea brasiliensis* Muell. Arg., is caused by the fungus *Fomes lignosus* (Klotzsch) Bres., or *Leptoporus lignosus* (Klot.) Heim ex Pat. as it is referred to in French literature (Roger, 1951).

This White Root disease fungus is widespread throughout the tropics. It also infects the roots of other cultivated plants of economic importance such as tea, coffee, cacao, coconut, oil palm and of numerous other plants including the leguminous plants used as shade trees or as ground covers *e.g. Erythrina, Albizzia, Leucaena, Tephrosia and Crotalaria.*

The White Root disease is of considerable economic importance to the rubber plantation industry of Ceylon as the loss of young trees due to this disease may be as high as 20% in certain areas. Supplying vacancies with budded stumps is not practicable after the second year of planting. Older budded material (stumped buddings) may be used for a further year, but thereafter it is impracticable to replace casualties unless they occur in a group, as the late supplies cannot successfully compete with the established plants and are unlikely to develop into useful trees.

White Root disease when present causes the most serious damage during the first four years of growth of young rubber trees in replanted areas; thereafter the losses from this cause diminish rapidly. On old trees the fungus may persist for many years, living on the roots without actually killing the tree or even producing obvious aboveground symptoms. When uprooting old stands, numerous cases can be observed where the roots of apparently healthy looking trees are found to be infected with *Fomes lignosus.*

Control methods:

Control methods are either preventive or curative. As this paper deals mainly with curative control methods only this brief mention is made of preventive control methods; these consist of the complete uprooting of jungle or old rubber trees, to ensure that as little as possible of the old root system is left in the ground, and of the removal of all infected timber from the area to be replanted with rubber.

The curative methods formerly in general use in young rubber plantings infected with the White Root disease relied mainly on the use of copper sulphate. The *Fomes*-infected main lateral roots were exposed and a 2 per cent solution of copper sulphate ($CuSo_4.5H_2O$) was applied with a cloth or a brush to the surface of the infected roots, after all the visible rhizomorphs of *Fomes lignosus* had been carefully removed (YOUNG, 1954). This method usually gave disappointing results as a high percentage of the treated trees later succumbed to the disease.

Laboratory Investigations:

Investigations were undertaken at the Rubber Research Institute of Ceylon to find a more effective fungicide than copper sulphate for the treatment of the White Root disease.

For this purpose a series of laboratory tests was carrried out with a wide range of fungicides using different testing methods. The four main testing methods were:

1. The fungus *Fomes lignosus* was allowed to grow on an artificial medium, such as malt agar (2% agar + 2% malt), in Petri dishes towards small filter-paper discs impregnated with a fungicide of a known concentration. The width of the growth inhibition zone formed around the paper discs was measured after a certain time and the results compared.

2. The fungicides were incorporated at different concentrations in a solid culture medium and the concentration of the fungicide which could just completely inhibit the growth of the fungus was determined.

3. The fungicides were added at different concentrations to a liquid culture medium contained in Erlenmeyer flasks. The growth rate of the fungus in different fungicidal solutions and in different concentrations of each solution was measured by dry weight determination of the mycelium produced. The concentration of the solution which could just completely inhibit the growth of the fungus was also determined.

4. The fungicides were tested by the method devised by ZENTMEYER (1948). This method allowed the testing of fungicides mixed with a small quantity of soil.

All these tests were carried out with different strains of *Fomes lignosus* isolated in Ceylon and in Malaya.

The fungicides tested were:

Sulphur-based fungicides: sulphur dust; sulphur wettable preparation; sulphur colloidal preparation.

Copper-based fungicides: copper sulphate; copper oxychloride wettable preparation; cuprous oxide wettable preparation.

Mercury-based fungicides: mercuric chloride; Agrosan; Tillex liquid.

Carbamate-based fungicides: di-sodium ethylene bis-dithiocarbamate; ferric dimethyldithiocarbamate; manganese ethylene bis-dithiocarbamate; nickel dibutyl dithiocarbamate; zinc dimethyldithiocarbamate; zinc ethylene bis-dithiocarbamate.

Other fungicides: Brunolinum plantarium; captan; Fylomac 90; karathane; Izal; Phygon; thiuram.

In these laboratory tests Tillex, an organo-mercurial fungicide containing as active ingredient an alkoxy-alkyl mercury compound equivalent to 2% mercury and compounded as a liquid, proved to be the most effective fungicide (RIGGENBACH, 1958).

Field Experiments:

Field experiments have shown that Tillex Liquid at the concentrations used has no phytotoxic effects on the plants and that it gives a most effective control of the White Root disease.

These experiments were repeated on a commercial scale on a number of collaborating estates with such excellent results that Tillex was officially recommended in 1958 by the Rubber Research Institute of Ceylon for the control of the White Root disease of *Hevea* (Rubber Research Institute of Ceylon, 1958).

The method recommended by the Institute for the control of the White Root disease is as follows:

Replanted areas to be closely inspected at frequent intervals and any tree which shows suspicious foliage symptoms of an infection by the White Root disease to be examined for rhizomorphs by exposing the main lateral roots near their junction with the tap root. If White Root disease which is easily identified by the presence of the fungal rhizomorphs on the roots, is found present, it is treated immediately and the source of infection is traced and removed.

The rhizomorphs on the infected roots are scraped off with a suitable tool and the exposed root surface is thoroughly treated by means of a brush or cloth with a 1% solution of Tillex Liquid in water. Any diseased roots too small to be treated are excised and removed. The exposed roots in the excavated hole are then watered with the Tillex solution and the earth when replaced is saturated with the same Tillex solution. All infected materials found are carefully collected and burnt.

It should be pointed out that the accepted method of treatment remains unchanged but the fungicide Tillex has been substituted for copper sulphate.

This new curative treatment of the White Root disease, using Tillex Liquid instead of copper sulphate, has been in use for the past three years on most commercial rubber plantations in Ceylon and reports received show that 80 to 90% of the young infected trees have been saved by this treatment.

For best results it is essential that the rubber plants are treated in the early stages of infection. Three examples taken at random show the following results.

Comparison of copper sulphate and Tillex treatment of White Root disease on three estates

Estates	Copper sulphate treatment			Tillex treatment		
	A	B*	C**	A	B	C
No. of trees treated ...	998	419	—	572	480	976
No. of mortalities subsequent to treatment ...	981	229	—	89	77	83
No. of trees saved ...	17	190	—	483	403	893
% of trees saved ...	1.7	45.3	—	84.4	83.9	91.4

*Copper sulphate treatment was carried out 4 times at intervals of 10 days.

**No copper sulphate treatment was carried out on this estate.

Recent experiments have shown that other mercury-based fungicides, with the same or similar active ingredients, such as Ceresan, Panogen and Verdasan are as effective as Tillex Liquid for the control of the White Root disease.

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PLANTING TOPICS

Phytophthora palmivora

A discussion on *Phytophthora*, the second of a series, took place at the headquarters of The Planters' Association of Ceylon on 26th October 1960.

It was attended by representatives of twenty Agency Houses, 33 Senior planters, 8 members of the Scientific staff of the Rubber Research Institute and provided an excellent opportunity for Colombo agents, planters and scientists to get together and compare notes on their experience in combating *Phytophthora* leaf and bark diseases during the *Phytophthora* season of 1960.

It was agreed that the greatly reduced incidence of *Phytophthora* diseases in 1960, compared with that of 1959, was mainly due to climatic factors which were less favourable to the development and spread of the fungus.

Field experiments on the control of *Phytophthora* were to some extent adversely affected by the low incidence of the disease but showed that no advantage is derived from early dusting rounds well in advance of the actual outbreak of the disease and that leaves may show signs of infection 4 to 5 days after the onset of the regular monsoonal rains.

They also showed that, provided effective coverage is obtained, spraying may be better than dusting and that oil-based sprays are better than water-based sprays.

Oil sprays were found to stick better to the leaves than water sprays and adequate control of leaf disease may be obtained by considerably fewer spraying rounds.

Sprays may not, however, reach the topmost leaves of tall trees and the real need would seem to be a spraying machine light enough to be carried by two labourers and powerful enough to give full coverage to the foliage of the tallest rubber tree.

Indirect control of the disease by destruction of flowers with the use of certain chemicals, incorporated in wettable sulphur sprays used for the control of *Oidium*, has not come up to expectations because of uncontrollable factors which do not allow the complete destruction of flowers.

It was stressed in discussion that rainfall is not the only major factor concerned in the incidence of *Phytophthora* as temperature is also of major importance, the optimum range of temperature being 70° to 80°F.

The important question of copper contamination of latex and of scrap was discussed at some length and it was pointed out that the highest values for copper content are usually found on the first two tapping days after dusting and that it was not therefore advisable to reduce the frequency of dusting to less than six days between rounds.

Ways and means of reducing the copper content of rubber from dusted areas were discussed and these included the question of no tapping on dusting days, the

use of polythene sheet rainguards, the blending of scrap collected from dusted and non-dusted areas and the soaking of the scrap, prior to milling, for at least 24 hours in a weak solution of oxalic acid.

The problem of copper contamination of rubber was discussed at the recent meeting of the International Rubber Study Group in Malaya which shows the great importance that consumer countries attach to it.

The question of Bark Rot was discussed at some length and considerable attention was given to the time of application of fungicide to the tapping panel.

The best results would be expected from applications made *after* tapping, either at the time of collection or later that afternoon, because of the better protection afforded to the tapping cut after the excision of bark by the tapping operation, provided the treatment is not prevented by rain.

Treatment *before* tapping ensures that the fungicide is applied on all tapping days but the degree of protection would not be expected to be as high since the treated bark is excised immediately after the application of fungicide.

Antimucin at a concentration of 1:120 has no detrimental effect either on the bark or on the yield but as the red dye in Antimucin WBR stains the scrap the colourless Antimucin WB should be preferred.

The incidence of bark infection should be appreciably reduced by the use of polythene sheet rainguards over the tapping panel.

E.D.C.B.

QUESTION CORNER

Question:

Could you please inform me whether there are, besides Tillex, any other fungicides which can be used for the control of the White Root disease of *Hevea?*

Answer:

During the past year we have had the opportunity to carry out laboratory tests with a number of different fungicides for their action on *Fomes lignosus.*

Among all the fungicides tested, only those containing an organo-mercurial compound as active ingredient proved very effective.

If applied at the appropriate concentrations, the effectiveness of these fungicides is comparable to that of Tillex. The appropriate concentration of these new fungicides for use against *Fomes lignosus* are:

CERESAN	(wettable powder):	2 oz. in 1 gallon of water
PANOGEN 15	(liquid):	$2\frac{1}{4}$ fluid oz. in 1 gallon of water
VERDASAN	(wettable powder):	2 oz. in 1 gallon of water

We have to point out, however, that so far we have only laboratory experience of these fungicides as they have not yet been used in field experiments.

A.R.

Question:

Do you recommend any fungicides besides Antimucin, for the control of Bark Rot of the tapping panel?

Answer:

During 1960 many chemically different fungicides were tested in our laboratories for their suitability as fungicides for the prevention and control of the Black Stripe or Bark Rot disease of the rubber tree caused by the fungus *Phytophthora palmivora.*

Of these fungicides those which contain copper compounds as active ingredients had to be rejected; others, mainly the organic fungicides, were comparatively ineffective either because of weak fungicidal action or because of poor sticking properties.

In our laboratory tests the following organo-mercurial fungicides (in alphabetical order) appeared to be the most effective against *Phytophthora palmivora.*

Antimucin	at $1\frac{1}{3}$ fluid oz. in 1 gallon of water
Ceresan	at 10 oz. in 1 gallon of water
Panogen 15	at $10\frac{1}{2}$ fluid oz. in 1 gallon of water
Verdasan	at 10 oz. in 1 gallon of water

Field experiments carried out with these fungicides in order to compare them with Antimucin were unfortunately inconclusive because of the low incidence of Bark Rot experienced during the S.W. Monsoon season 1960.

A.R.

Question:

Despite all precautions taken (checking of metrolac, etc.) there has been a shortage between the field and factory weights of latex on my estate and the indication is that the tappers are in fact receiving a greater poundage than what they bring. I shall be grateful for your advice on this subject.

Answer:

The metrolac is a special type of hydrometer, an instrument to measure the specific gravity of a liquid, and is graduated in pounds of rubber per gallon of latex instead of in units of specific gravity. The assumption underlying the use of the metrolac is that the relation between the specific gravity and the d.r.c. of field latex is consistent irrespective of the source and dilution of the original latex, an assumption which is not necessarily correct.

The metrolac is calibrated for a d.r.c. of $3\frac{1}{2}$ lb. per gallon, and it will, therefore, underestimate the dry rubber content of latex with a d.r.c. lower than $3\frac{1}{2}$ lb. per gallon, overestimate the dry rubber content of latex with a d.r.c. of over $3\frac{1}{2}$ lb. per gallon and read correctly only for latex with a d.r.c. of about $3\frac{1}{2}$ lb. per gallon.

The d.r.c. of latex varies, depending on factors such as the type of planting material, seasonal influences, age of the trees etc.

The metrolac may not work in the latices of certain clones with a tendency to incipient precoagulation. In such cases an anticoagulant should be added to the latex in the field. If despite the addition of an anticoagulant the metrolac does not work according to the normal dilution, *i.e.* 1 part of latex with 1 part of water, a dilution of 1 part of latex with 2 parts of water should be used. In the latter case the weight of the rubber is calculated by multiplying the metrolac reading in lb. and oz. by the number of pints and then by 3 and dividing the result by 8, *i.e.* if the metrolac reading is 1 lb. 2 oz. and the number of pints is 20, the estimated total rubber is:

$$\frac{1 \text{ lb. } 2 \text{ oz.} \times 20 \times 3}{8} = 135 \text{ oz.}$$

It must be emphasized that all readings of the metrolac should be taken after ensuring that the instrument moves quite freely in the diluted sample of latex. The metrolac moves rather slowly in latex due to its viscosity and may take sometime to adjust itself to the correct reading. In normal estate practice the reading is made very soon after the insertion of the metrolac into the latex. A rough surface

of the metrolac caused by some adhering rubber coagulum or froth on the latex surface, or the angle at which the reading is taken will influence the results. Fine air bubbles in the latex due to pouring, stirring or shaking will affect the density of the latex and, consequently, the reading of the metrolac.

For the above reasons the d.r.c. determined by metrolac must be regarded as an approximate figure. In cases of considerable deviations between field and factory weights or, if the instrument does not move freely even after diluting the latex with 2 parts of water, the estimation of the d.r.c. of latex should be done by trial coagulation.

The following procedure of determining the d.r.c. of latex by trial coagulation may be adopted on estates:—

Exactly one gallon of the sample of diluted latex, from which the metrolac reading has been taken, is poured into a coagulating pan. The measure is rinsed out with ½ pint of water which is added to the latex. The latex is coagulated by the addition of 12 fluid ounces of a 1% solution of formic acid (made by adding 1 fluid ounce of undiluted acid to 4½ pints of water) and thorough stirring.

When coagulation is complete the coagulum is rolled either in a sheet roller or in a creping mill, taking care that none of the sample is lost. After drying the rubber is weighed on a spring balance, or on scales accurate to 1 oz., and the weight multiplied by the dilution (if the latex is mixed with 1 part of water, the dilution is 2 and if the latex is mixed with 2 parts of water, the dilution is 3) represents the rubber content of the original undiluted latex in pounds per gallon.

Whenever a considerable shortage between field and factory weights is noticed, the d.r.c. of the suspected latices should be determined by trial coagulation and by metrolac. The difference between these two determinations will provide the correction factors for use with the metrolac readings.

K. F. H.

RUBBER RESEARCH BOARD

169th Meeting

Minutes of the 169th meeting of the Rubber Research Board held at 10 a.m. on Friday 28th October, 1960 in the Board Room of Messrs. Aitken Spence & Co., Ltd., Lloyd Building, Prince Street, Colombo.

Present:—Mr. S. Pathmanathan (in the Chair), Mr. H. Creighton, Mr. L. C. de Mel, Mr. W. P. H. Dias, J. P., Senator L. Jayasundera, Mr. B. Mahadeva (Rubber Controller), Mr. H. E. Peries (Deputy Secretary to the Treasury), Mr. A. V. Richards (Director of Agriculture), Mr. C. R. Warren, Mr. D. P. R. Weerasekera, M. P., Dr. E. D. C. Baptiste (Director) and Mr. C. D. de Fonseka (Chief Administrative Officer).

1. **Board—Changes in Membership.**—The Chairman welcomed:

   (*a*) Mr. D. P. R. Weerasekera, M.P., who had been nominated to represent the House of Representatives, in place of Mr. V. T. G. Karunaratne, M.P., with effect from 10th August, 1960, and
   (*b*) Mr. H. Creighton and Mr. C. R. Warren who had resumed membership, with effect from 15th September and 15th October, 1960, respectively, on return from leave.

Messrs. V. T. G. Karunaratne, W. B. Jonklaas and G. H. Carter were thanked for their services during their periods of membership.

2. **Minutes:**

(A) *Confirmation.*—Draft minutes of the meeting held on 22nd July, 1960, which had been circulated to members, were signed by the Chairman.

(B) *Matters arising from minutes:*

   (*a*) Power Supply.—As recommended in the report of the General Manager, Department of Government Electrical Undertakings, dated 26th October, 1960, it was decided that fresh tenders be called on the basis of the revised specifications for rectifiers and that these tenders be examined by the Administrative Committee in consultation with the Chief Commercial Officer of the Department of Government Electrical Undertakings.

   (*b*) Shop and Office Employees' Act. No. 9 of 1954.—It was decided to place before the Minister the terms and conditions of employment available at the Institute and to seek clarification in regard to the interpretation and application of certain sections of the Act.

   (*c*) Crepe Drying Tower.—Award of a contract, on agreed terms, was approved.

   (*d*) Director.—It was agreed that during the absence of the Director from 20th December, 1960, to about 10th March, 1961;

(i) Mr. C. A. de Silva, Botanist, should be Acting Director; and
(ii) Mr. C. D. de Fonseka, Chief Administrative Officer, should attend to administrative work.

3. **Administrative Committee.**—Recommendations made at the meetings held on 14th September and 14th October, 1960 were approved, and the following decisions were arrived at on the basis of these recommendations:

(A) *Research Programme for* 1961—was approved. It was noted that:

(*a*) Arrangements would be made for scientific officers of the three Research Institutes, the Department of Agriculture and the University of Ceylon to meet at regular intervals for the discussion of common problems;

(*b*) Pathology Department—Additional work on the control of Phytophthora work would be undertaken in 1961;

(*c*) Meteorological observations would be made at Dartonfield; and

(*d*) The Rubber Chemist would shortly publish a report on his work on copper contamination in the Quarterly Journal.

(B) *Tenders for Buildings.*—It was agreed to award contracts for the following:—

(*a*) At Dartonfield Group:
(i) Extensions to Administration Block and Estate Office;
(ii) Improvements and additions to staff bungalows;
(iii) Additions to Assistant Superintendent's bungalow at Hedigalla;
(iv) Construction of two wells; and
(v) Installation of lightning conductors to staff bungalows.

(*b*) At Kuruwita Sub-station:
(i) Coagulating and rolling shed cum store and office;
(ii) Bungalow for Senior Field Assistant; and
(iii) Smokehouse of 5,000 lb. capacity.

(C) *Research Assistants' Training:*

(*a*) Research Assistants who are sent abroad for training should be given the opportunity to obtain a Ph.D. degree; and

(*b*) The period of scholarship of Mr. O. S. Peries, Assistant Plant Pathologist, who is at present at the University of Bristol, be extended by three months to enable him to obtain a doctorate.

(D) *Phytophthora Conference.*—A suggestion made by the Planters' Association of Ceylon for a second discussion on Phytophthora was approved and 26th October was agreed to be a suitable date.

(E) *Estate Superintendent.*—It was agreed that Mr. D. de S. de Fonseka, Assistant Superintendent, should act for Mr. L. Wijeyegunawardena, Estate Superintendent, who would be on leave from 15th November, 1960 to 15th January, 1961.

(F) *Representation on IRRDB.*—The Chairman and the Director were nominated to serve on the International Rubber Research and Development Board.

4. Estate and Experimental Committee.—The recommendations made at the meetings held on 5th August and 14th October, 1960, were approved.

5. Smallholdings Committee.—The recommendations made at the meeting held on 8th August, 1960, were approved.

The sulphur dusting proposals for 1960/61 were considered and it was noted that it is proposed to sulphur dust an extent of 8,500 acres at a total cost of Rs. 100,000/-, inclusive of Rs. 23,000/- for the purchase of 17 new dusting machines.

6. Salaries Committee.—The recommendations made at the meeting held on 14th October, 1960, were approved.

It was decided to amend the rules of the R.R.I.C. Provident Fund in order to provide authority for the grant of housing loans to members of the staff.

7. Selection Committee.—The recommendations made at the meetings held on 26th July and 27th October, 1960, were approved.

8. Staff: It was noted that:—

(*a*) *Chief Advisory Officer Smallholdings.*—Mr. A. B. Dissanayake, B.Sc. Agric. (Ceylon), had assumed duties on 16th August, 1960; and

(*b*) *Research Assistant, Soils Department.*—Mr. M. P. Wesenti-Pulle, B.Sc. (Ceylon), had assumed duties on 1st October, 1960.

9. Reports and Accounts:

(*a*) *Draft Estimates for* 1961.—The Estimates of Income and Expenditure for 1961, as revised in accordance with the recommendations of the Administrative Committee, were approved. The estimates provide for income and expenditure as follows:—

Estimated income ...	...	Rs.	2,573,175
Estimated expenditure:			
Recurrent ...	Rs. 2,464,974		
Capital ...	,, 535,082		
		,,	3,000,056
Estimated excess of expenditure over income		Rs.	426,881

(*b*) *Inventory Report for* 1959—was approved.

(*c*) *Auditor-General's Report for* 1959—was considered and adopted.

RUBBER RESEARCH BOARD

170th Meeting

Minutes of the 170th meeting of the Rubber Research Board held at the Headquarters of the Planters' Association of Ceylon, 73/1, Kollupitiya Road, Colombo, at 10 a.m. on Monday, 5th December, 1960.

Present:—Mr. S. Pathmanathan (in the Chair), Mr. W. P. H. Dias, J.P., Mr. L. C. de Mel, Mr. H. E. Peries (Deputy Secretary to the Treasury), Mr. C. R. Warren, Mr. D. P. R. Weerasekera, M.P., Dr. E. D. C. Baptiste (Director) and Mr. C. D. de Fonseka (Chief Administrative Officer).

Mr. H. Creighton, Senator L. Jayasundera, Mr. B. Mahadeva (Rubber Controller) and Mr. A. V. Richards (Director of Agriculture) had intimated their inability to be present.

1. Minutes:

Draft minutes of the meeting held on 28th October,1960, which had been circulated to members, were signed by the Chairman.

2. Administrative Committee:

The recommendations made at the meeting held on 17th November, 1960, were considered; the Board's decisions included the following:—

(*a*) *Power Supply—Dartonfield.*—It was decided to enter into a contract with one of the tenderers for the supply and installation of equipment in connection with the acceptance of Government A.C. electrical supply.

(*b*) *Assistant Administrative Officer.*—It was decided to appoint Mr. P. A. Jayawardena B.Sc. (Lond.), A.C.A.

(*c*) *Works Inspector.*—It was decided to appoint Mr. P. C. J. F. Keerthisingha.

(*d*) *Rubber Chemist.*—Dr. K. F. Heinisch was granted permission to visit the Natural Rubber Producers' Research Association during his forthcoming overseas leave.

(*e*) *Research Assistant, Chemistry Department.*—The decision that Mr. S. W. Karunaratne be offered the appointment was confirmed.

(*f*) *Exchange of clones with R.R.I. Malaya.*—Under the existing arrangement for exchange of clones between the Rubber Research Institutes of Ceylon and Malaya, the exchange of budwood of RRIC 52 and IAN BC2 clones with budwood of clones RRIM 628 and ES 1, 2, 3, 6, 7 & 9 was approved.

(*g*) *Training of F. A. O. Fellows from Thailand.*—It was agreed to provide training in rubber planting and allied subjects for a period of one month to 3 F.A.O. Fellows from Thailand.

(*h*) *Smallholdings Department.*—It was decided to publish in Sinhala the Smallholdings Department's Annual Report for distribution to smallholders.

3. Reports and Accounts:

(*a*) *Receipts and Payments Accounts for the 2nd & 3rd Quarters* 1960.—were approved.

(*b*) *Capital votes.*—The Director stated that he expected to receive shortly the final plans for a greenhouse from the Architects who had constructed a greenhouse at the R.R.I. Malaya.

(*c*) *Termination Report of Mr. W. E. Manis, Plant Breeder.*—was considered and the Board recorded its thanks to Mr. W. E. Manis and the United States Operations Mission for the valuable assistance given by them.

(*d*) *Report of a meeting of Chief Executives and Directors of Research and Development I.R.R.B/I.R.D.C. held on* 11-7-60.—was adopted.

4. Staff:

(*a*) *Chemistry Department.*—It was agreed that Mr. M. Nadarajah, Assistant Rubber Chemist, should act for the Rubber Chemist while Dr. K. F. Heinisch was away on leave for about 4 months from 21st December, 1960.

(*b*) *Assistant & Minor Staff Changes.*—Changes in staff since the last meeting were reported and approved.

(*c*) *Loans to officers for purchase of transport.*—Five loans given to officers for purchase of transport were reported and approved.

5. Publications:

(*a*) The following publications were tabled:—

(i) 1st and 2nd Quarterly Journals, March/June, 1960.

(ii) Advisory Circular No. 68—Minor Pests of Rubber Plantations.

(iii) Article on "Breeding for High Yield and Disease Resistance in Hevea" by E. D. C. Baptiste, Director.

(iv) „ "The Performance of RRIC Clones under Ceylon Conditions" by C. A. de Silva, Botanist.

(v) „ "Comparative Studies of the Chemical Composition of some Cover Plants" by A. J. Jeevaratnam, Soils Chemist.

(vi) „ "Recent Progress in the Control of the White Root Disease of Hevea" by A. Riggenbach, Plant Pathologist.

(vii) „ "Investigation of Mould Growth on Sheet Rubber" by K. F. Heinisch, Rubber Chemist and M. Nadarajah, Assistant Rubber Chemist.

(*b*) *Chemist's article on TC-rubber.*—The Chemist was granted permission to publish an article written by him on TC-rubber in the German journal "Gummi und Asbest".

6. Board Membership:

The Chairman reported that the period of membership of himself and Mr. L. C. de Mel would terminate on 20th January, 1961, and that the L.C.P.A. had nominated Messrs. T. C. A. de Soysa and Nelson Abeygunawardena in their place. He thanked all the members, the Director and the Chief Administrative Officer for the ready co-operation and assistance given to him during his six-year period of office as Chairman.

Mr. W. P. H. Dias, on behalf of members, referred to the cordial relations which had existed between the Chairman and Board Members during Mr. Pathmanathan's term of office as Chairman and thanked him for the very able manner in which he had conducted Board meetings. Mr. Weerasekera associated himself with these sentiments.

The Director, on behalf of the Staff, thanked Mr. Pathmanathan for the ready assistance given by him in conducting the work of the Institute.

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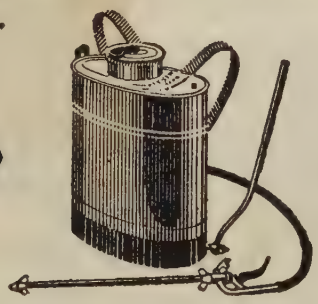

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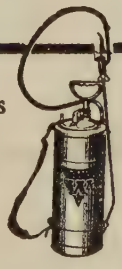

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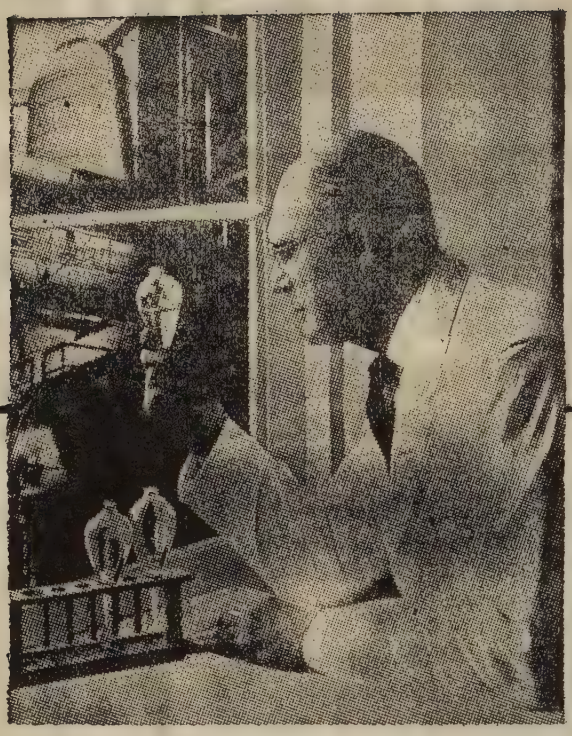

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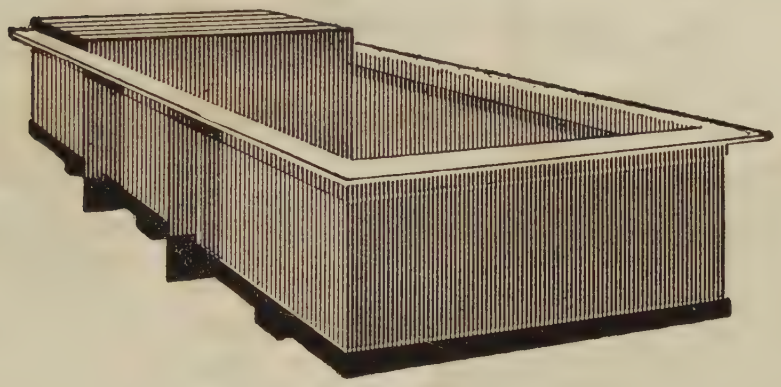

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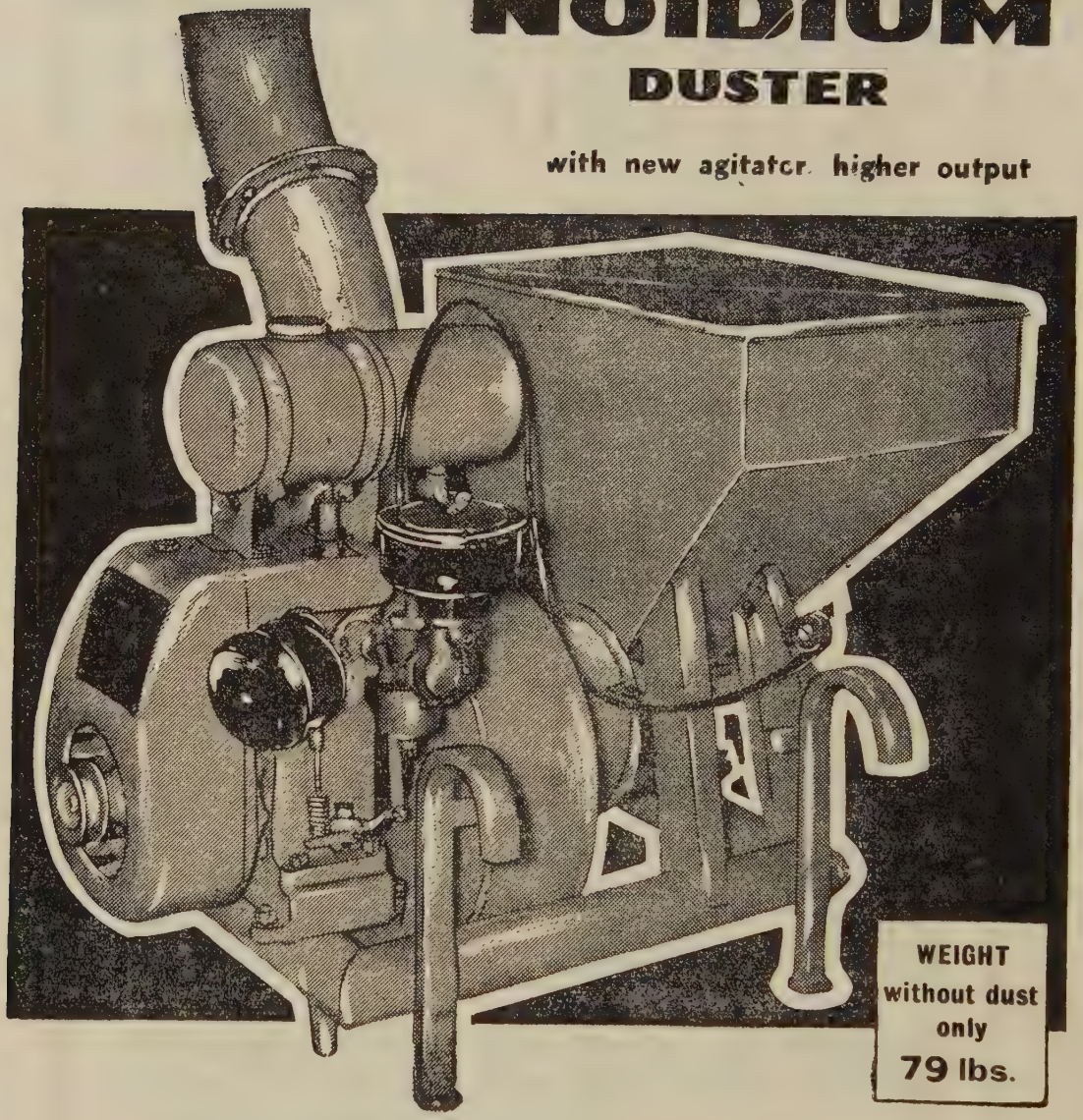

RELIABLE POWER UNIT

The Villiers 4 stroke engine is easy to start, is not subject to rapid cylinder wear during copper dusting.

HIGHER OUTPUT, EVEN FEED

The new agitator prevents "bridging", gives positive, constant feed. The output can be controlled as desired, but the maximum rate possible has been increased.

DISCHARGE FREE FROM LUMPS

The dust is fed on to the fan blades, which run at 3000 rpm, and all lumps are broken up by the impact. The dust is discharged as a soft powder.

Equally efficient for both Sulphur and Copper Dusting.

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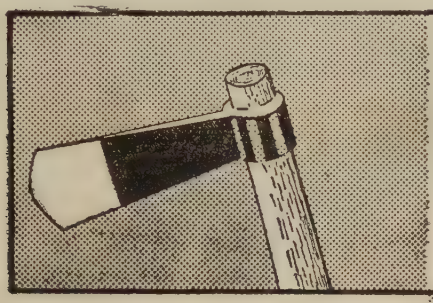
Tools that stand up to it

Biped Tools are made in England by A. & F. Parkes & Co. Ltd., from the finest steel and are available in patterns to suit Ceylon's specific requirements. We stock the following range of Biped brand estate tools, alavangoes, felling axes, mamoties, mamoty forks, quintannies and cultivators.

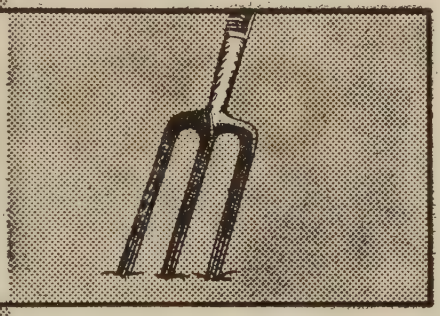


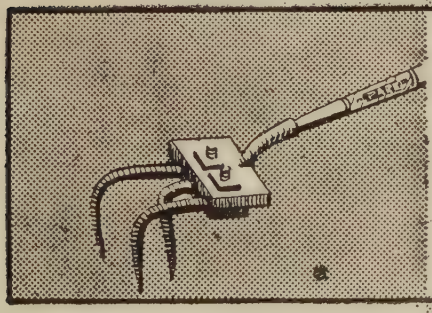
FELLING AXE

Felling time is considerably reduced because the blade rarely needs honing.

DIGGING FORKS

Bayonet Prong 3 x 18" or Square Prong 4 x 18" really strong and reliable.





3-PRONG DRAG CULTIVATOR

Recommended to take the place of short-tined forks for light cultivation.

MAMOTIES

Very effective, low-priced and fully guaranteed. Made to the right weight to suit local requirements.

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BY DUSTING WITH

OXYCAR

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CHARTERED BANK BUILDING,
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LOST...

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WOOD PRESERVATIVE

will give you:

Permanent protection from all enemies of timber – white ants, borers, rot and fungi.

No unpleasant odour.

Four gallons ready to use from every one gallon tin.

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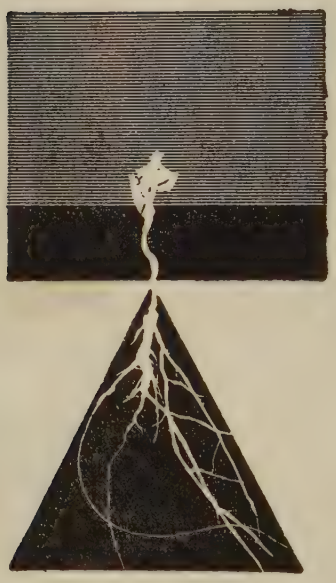

Simazine 50W

persistent | selective | safe

prevents weeds in RUBBER

Weed-free rows in immature rubber can be maintained throughout the year with Simazine 50W.
Grasses as well as broadleaved weeds are controlled by Simazine 50W.

Supplies and information from: **FISONS (CEYLON) LTD.,**
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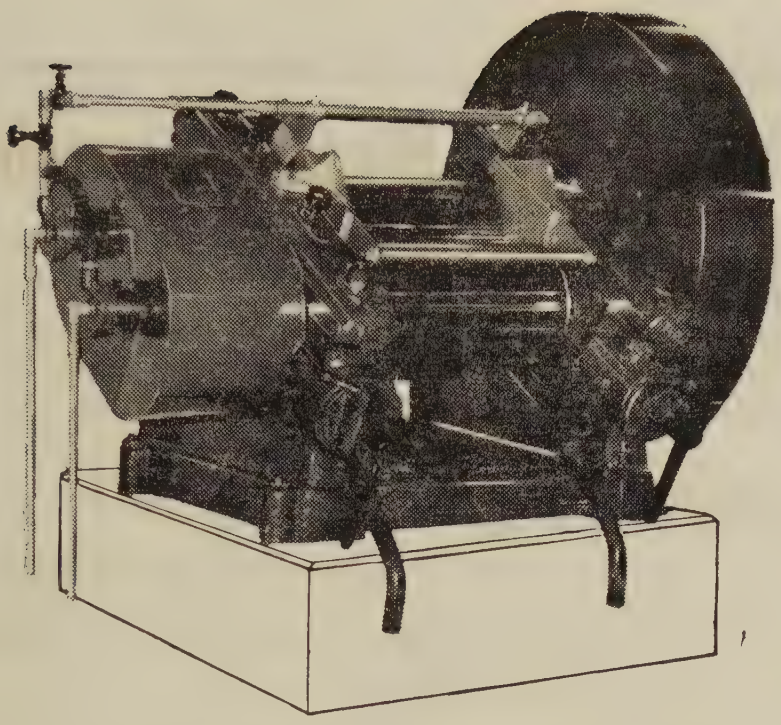
FISONS CEYLON LIMITED



C C C 26" x 14" ANGLE TYPE RUBBER WASHING MILL

Low maintenance costs, permanently accurate alignment, and freedom from vibration during even the hardest rolls explain the permanent popularity of the CCC Rubber Washing Mill in Ceylon and Malaya. Over 300 of these machines are in daily use in these two largest rubber-producing countries.

Their immense strength ensures years of trouble free use.

Proved thoroughly efficient for

Macerating. Washing. Creping. Sheeting. Blanketing Sole-creping.

All rolls and driving gear are imported.

We supply any type of internally water-cooled rolls of close grain or chilled cast iron with smooth surface or grooved to any desired pattern.

Consult us for your special requirements :

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Brunolinum Wood Preserver and Brunolinum Plantarium are Products evolved as the result of Patient and continued research, which as Germicides are highly toxic, non-dangerous and safely handled. These products have been used in Ceylon for many years with the greatest success.

BRUNOLINUM WOOD PRESERVER

One of the most effective Wood Preservers and white ant destroyer known. Protects all varieties of woods from decay. Invaluable for all kinds of internal and external wood work.

DARK BROWN IN COLOUR

Supplied in bottles, 1 Gal. and 5 Gal. Drums

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Prevents and cures all diseases of Rubber trees.

- For prevention of diseases of the tapping cut.
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Supplied in bottles, 1 gal. and 5 gal. drums.

A booklet descriptive of its great value and expert opinions in Ceylon and the Straits will be posted free on application.

The Ironmongers & Estate Suppliers of Ceylon.

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Planters Will Keep Country Ahead !!!

FULL PRODUCTION—HIGHER WAGES—GREATER CONSUMPTION—BETTER PRICES

And support higher living standards and increased internal consumption markets

Grow **CLOVERS—GREEN MANURE COVER CROPS—BUSH COVERS GROUND COVERS—TREE COVERS**

Most effective Natural Manures—They give your Money better Results

Help *SOIL CONSERVATION* Retain *SOIL MOISTURE*

Add humus or vegetable matter to the soil, which increase capacity to retain rain water on lands. Prevent surface soil wash and erosion. Suppress weeds, thus, saving on labour. Leguminous plants fix atmospheric nitrogen in soil. Ensure continuity of full production with the increased fertility by the conservation of top soils under cover crops. Organic matter and leaf mould deposits help retain rain water on lands.

Now considered an advance in agriculture and is a requirement under Government Subsidised Schemes that Tea, Rubber, Cocoa and Coconut Replantings of uneconomic fields should be perfectly covered with leguminous green manure cover crops during first year before final payments are made.

To obtain best results, mix two parts of seed with one part of Saphos Phosphates and one part of dry earth or sand and sow in beds 4ft. by 4ft. and 6ft. apart between the rows of your plantation in the case of Creeper Ground Covers and sow in drills between the rows of your plantation and in ridges and contour bunds in the case of Bush Cover Crops. Tree Covers are established for shade, as Windbelts and for Timber and Fuel Purposes.

GOVERNMENT NOW CONTEMPLATES ENFORCING LEGISLATION ON SOIL CONSERVATION!!

If a bottle of water is poured into a tray filled with sand, the water is completely drained out. The same quantity of water is poured into a tray filled with earth, only a fraction of the water is retained and the major portion of the water is drained out. See the same quantity of water poured into a tray filled with leaf mould and organic matter, the water is sucked in completely and practically all the water is retained in the tray. Thus, in sandy soils, all rain water is drained out and on other soils, only a part is retained on the land, but, where Leguminous Green Manure Cover Crops are established, all the rain water is retained on your land due to organic matter, dry leaf mould and green mulching.

As recommended by U.S.A. Agriculturists and now accepted and approved as an advance in Agriculture by the Food & Agricultural Organisation of the U.N.O. advocating free exports.

SOW FRESH SEEDS. AVAILABLE FROM US. Write for List to

H. D. CONSTANTINE & SONS

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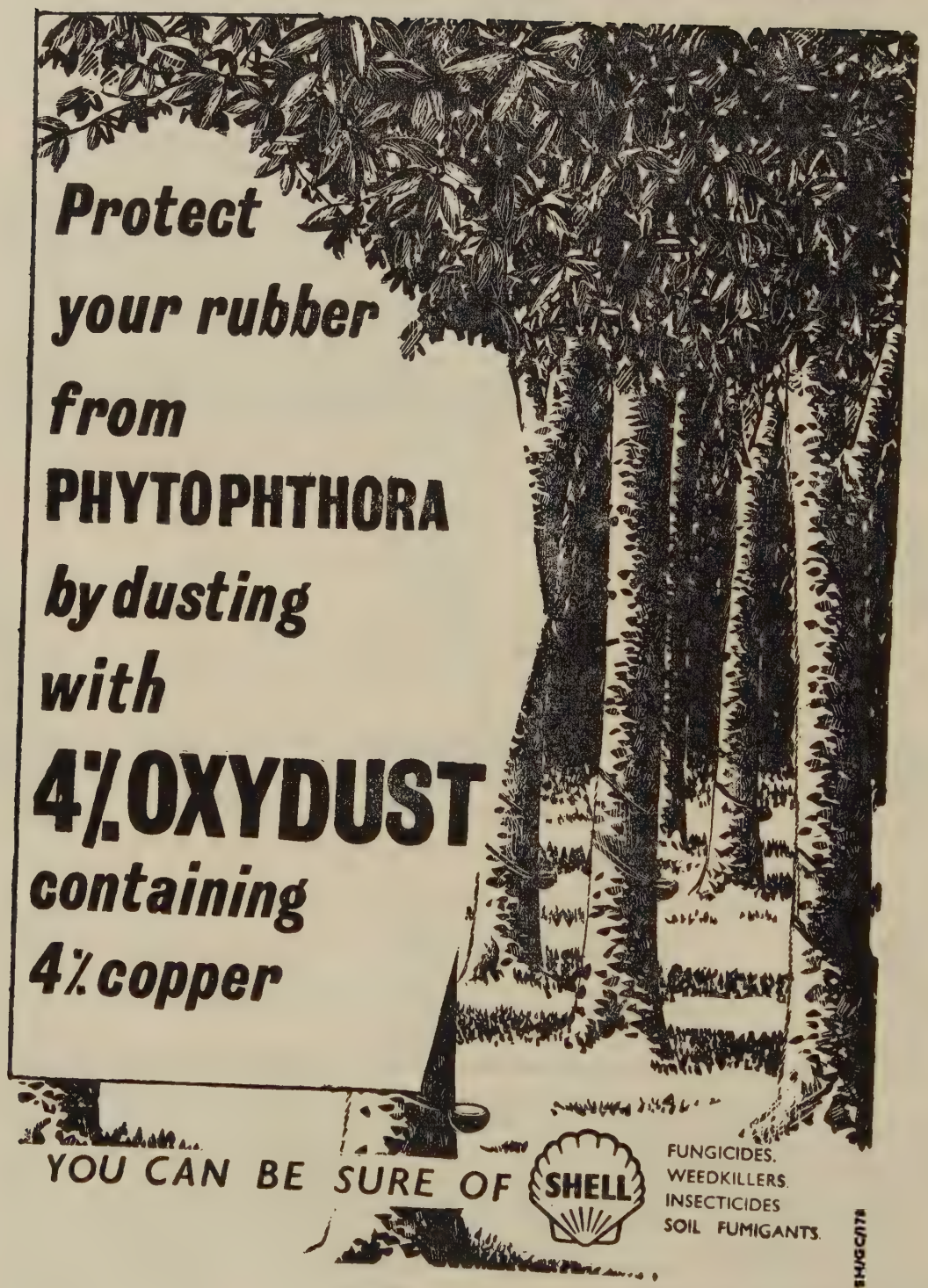
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YOU CAN BE SURE OF SHELL
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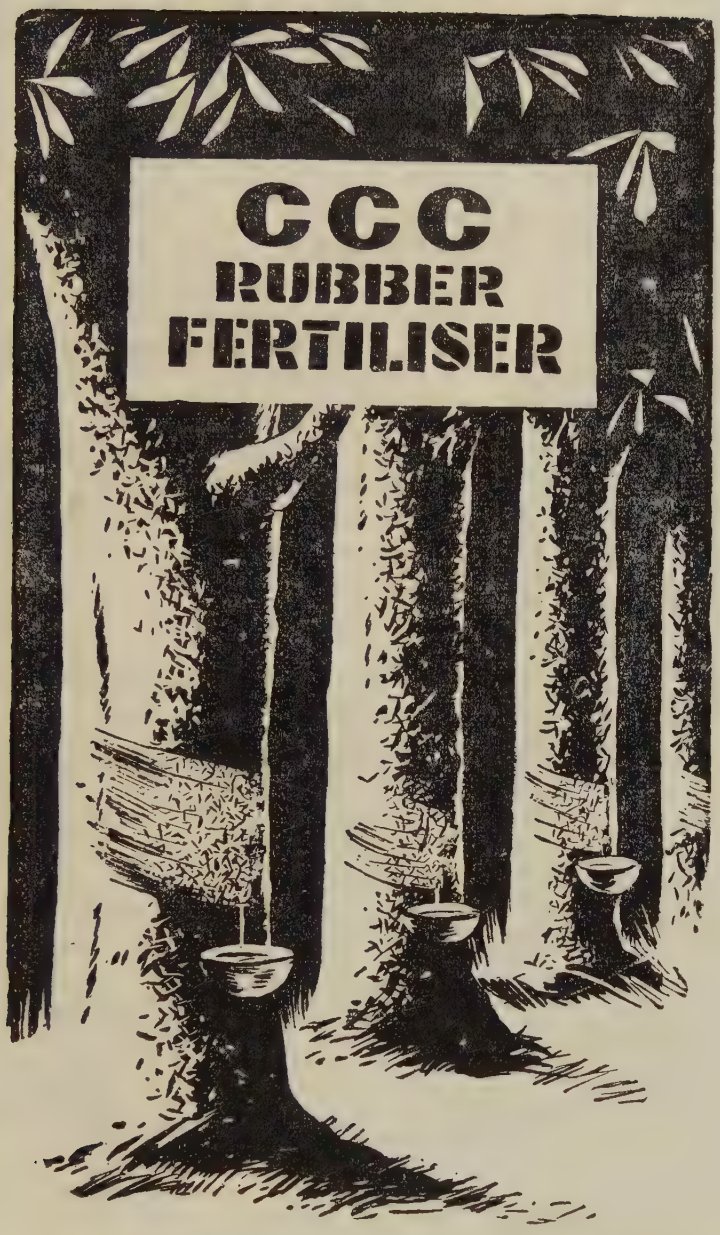

FINEST ON EARTH

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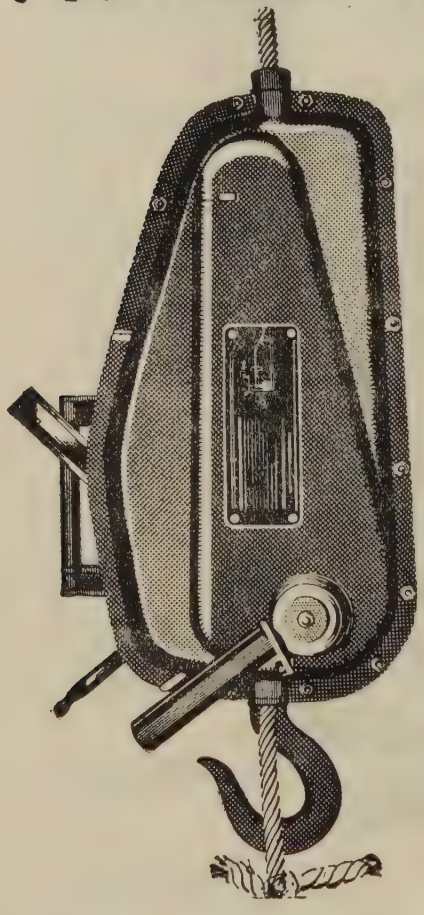
THE *TIRFOR* PORTABLE WINCH



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Salient features:

- **Easily carried and operated by one man**
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- **Precision lowering or lifting to a fraction of an inch**
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LIGHT — 88 lbs. (without handles)—amazingly portable.

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STURDY — solid rigid cast construction cuts down vibration.

TROUBLE FREE — deals efficiently with lumpy sulphur.

designed for efficient and economical dusting

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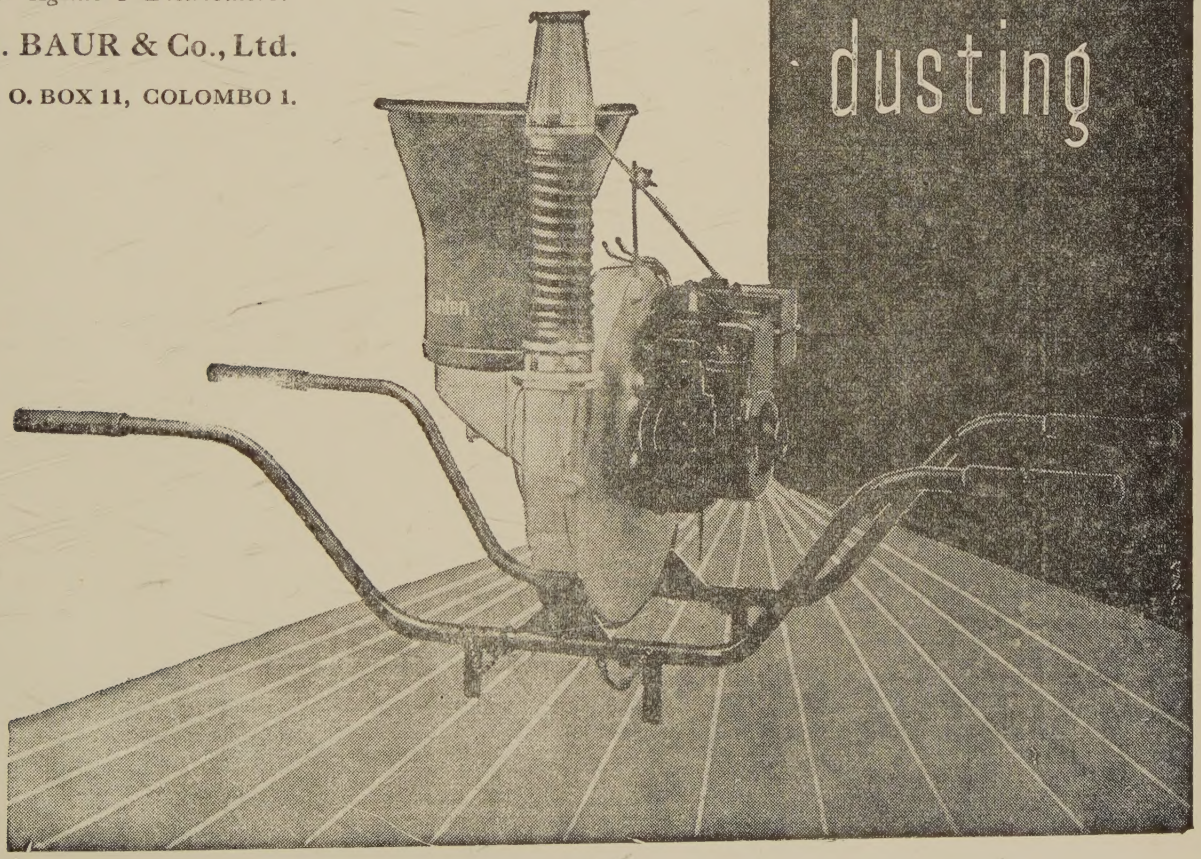

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